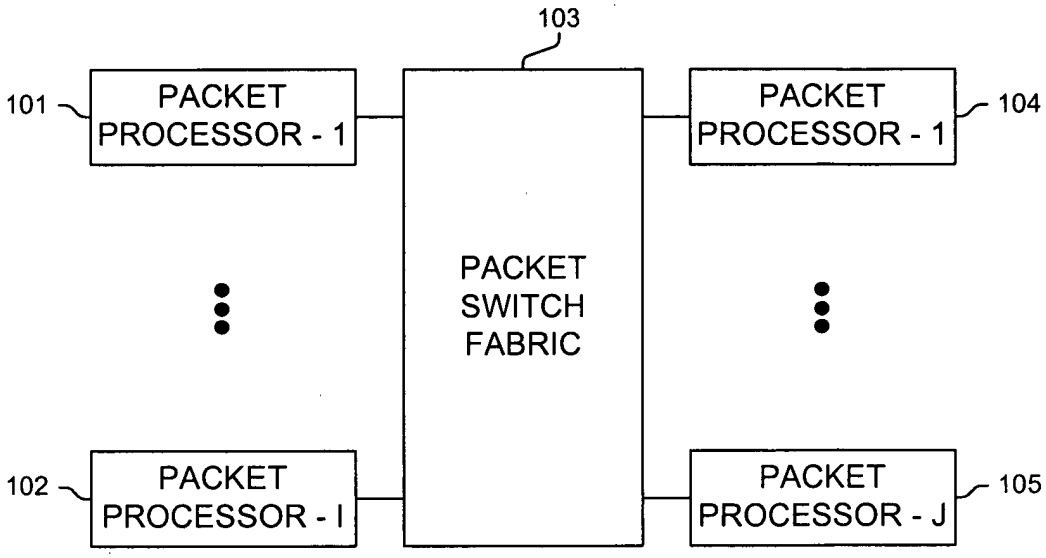

FIGURE 1A

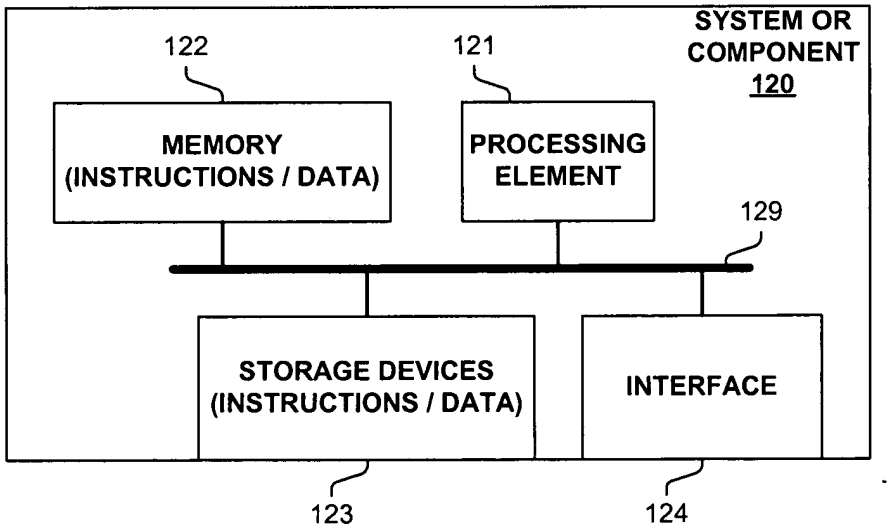

FIGURE 1B

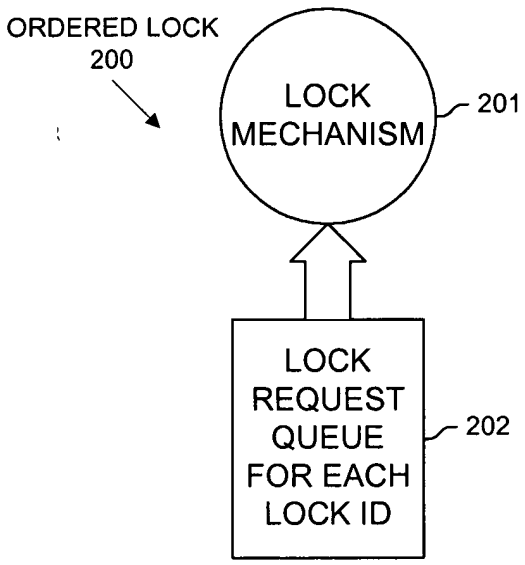

FIGURE 2A

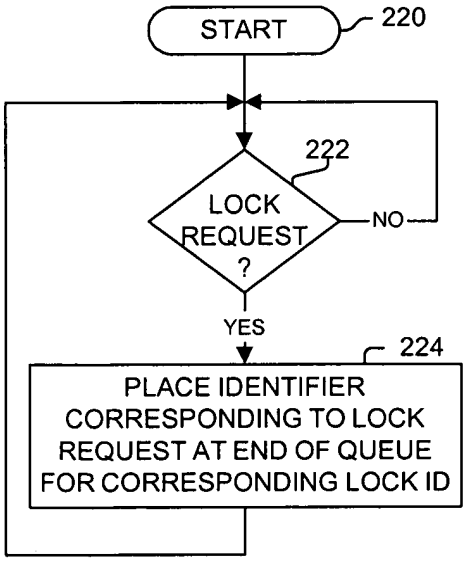

FIGURE 2B

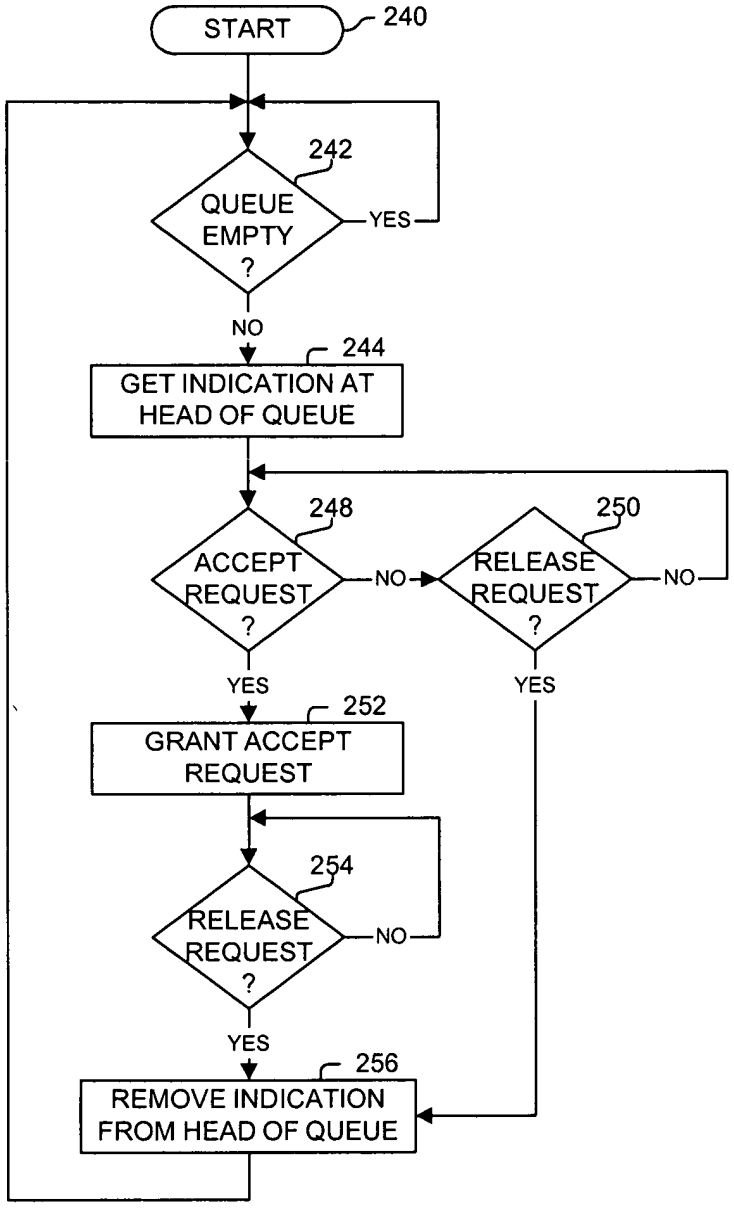
START
240
242
QUEUE EMPTY ?
YES
NO
244
GET INDICATION AT HEAD OF QUEUE
248
ACCEPT REQUEST ?
NO
250
RELEASE REQUEST ?
NO
YES
YES
252
GRANT ACCEPT REQUEST
254
RELEASE REQUEST ?
NO
YES
256
REMOVE INDICATION FROM HEAD OF QUEUE

FIGURE 2C

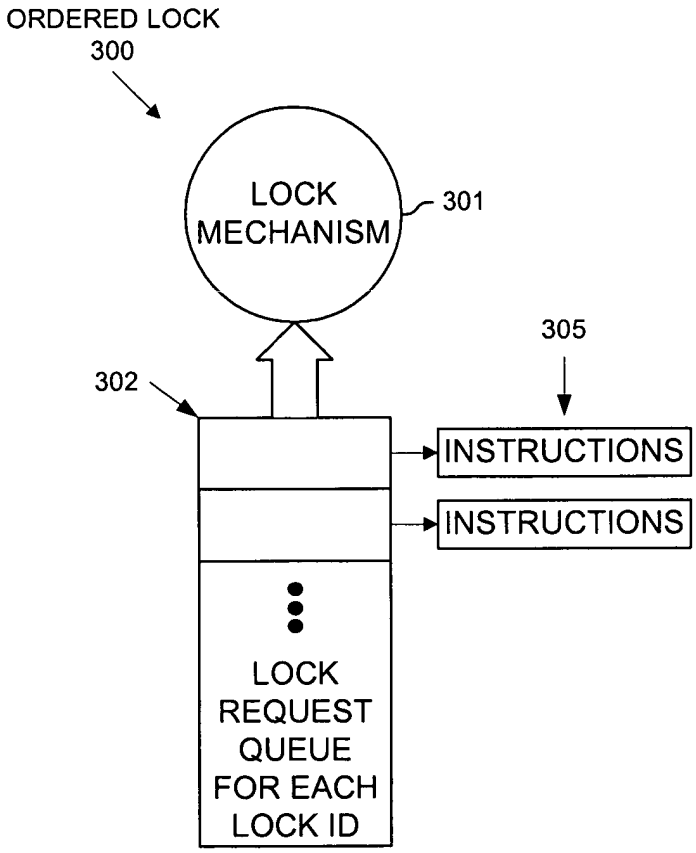
ORDERED LOCK
300
LOCK
MECHANISM
301
305
302
INSTRUCTIONS
INSTRUCTIONS
LOCK
REQUEST
QUEUE
FOR EACH
LOCK ID

FIGURE 3A

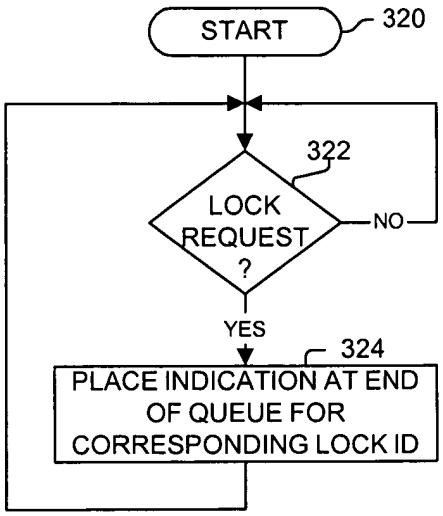

FIGURE 3B

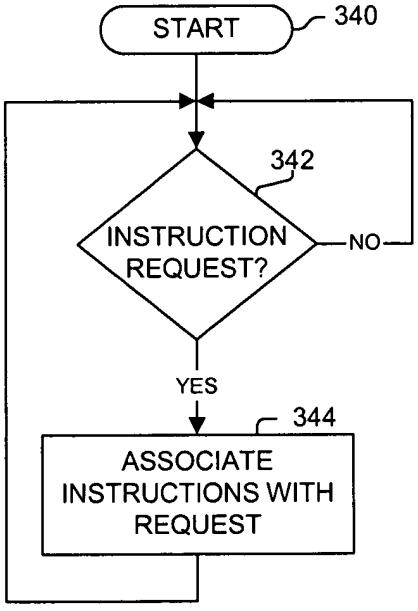

FIGURE 3C

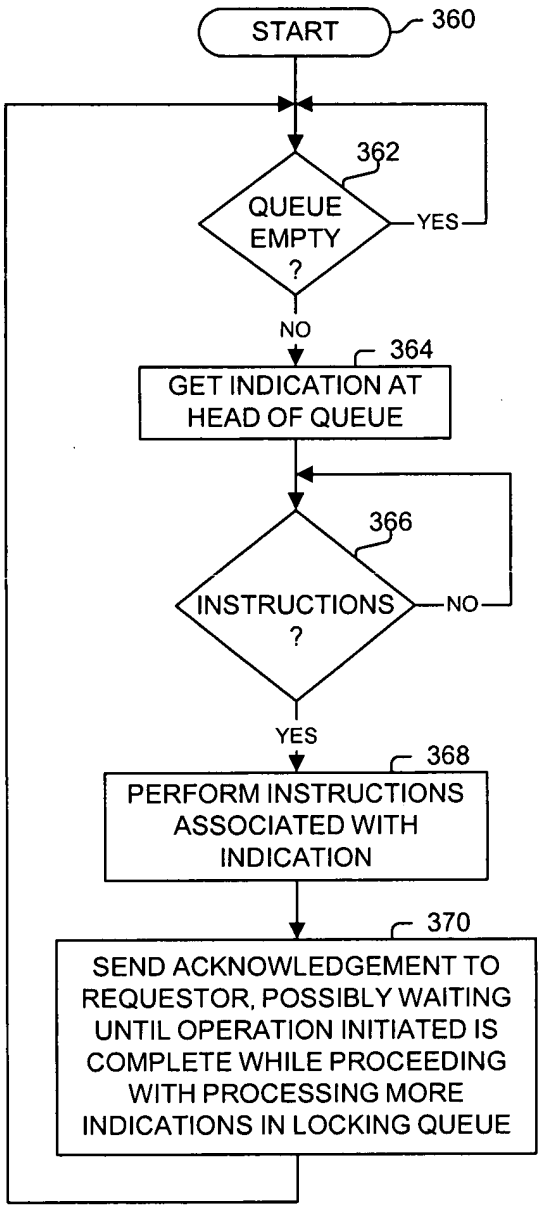
START
360
362
QUEUE EMPTY ?
YES
NO
364
GET INDICATION AT HEAD OF QUEUE
366
INSTRUCTIONS ?
NO
YES
368
PERFORM INSTRUCTIONS ASSOCIATED WITH INDICATION
370
SEND ACKNOWLEDGEMENT TO REQUESTOR, POSSIBLY WAITING UNTIL OPERATION INITIATED IS COMPLETE WHILE PROCEEDING WITH PROCESSING MORE INDICATIONS IN LOCKING QUEUE

FIGURE 3D

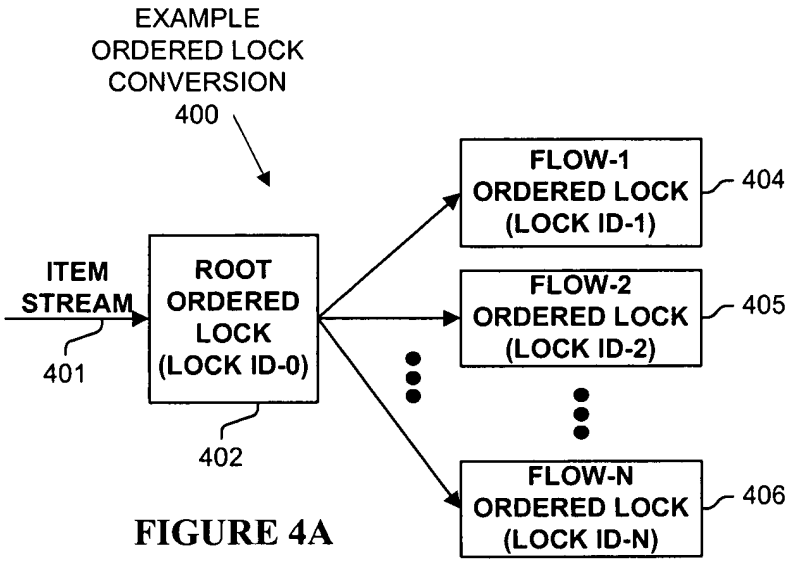

FIGURE 4A

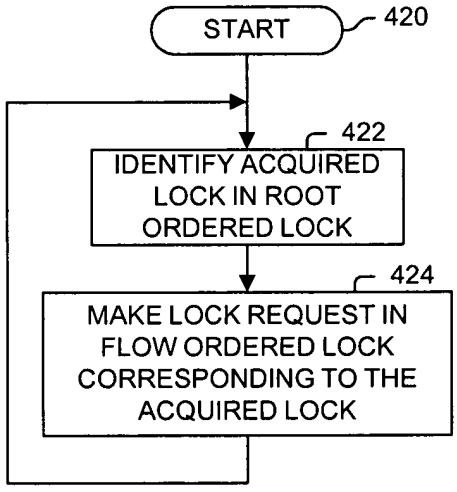

FIGURE 4B

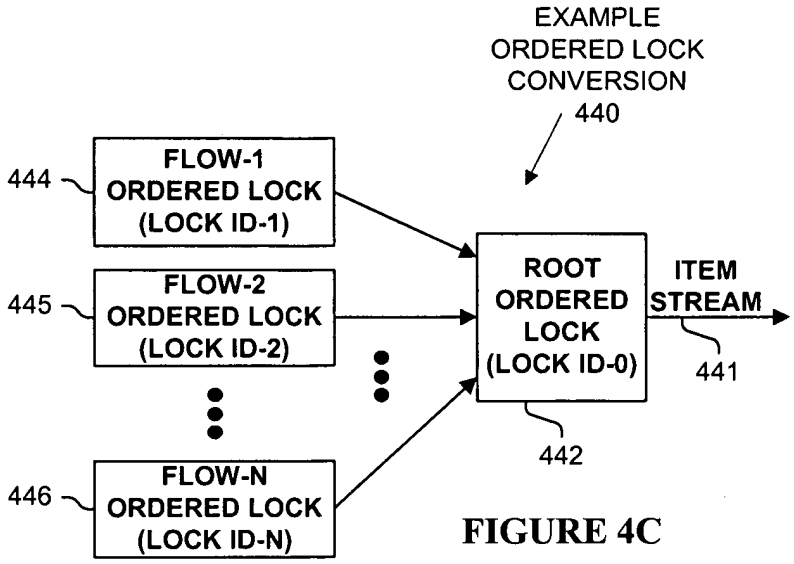

FIGURE 4C

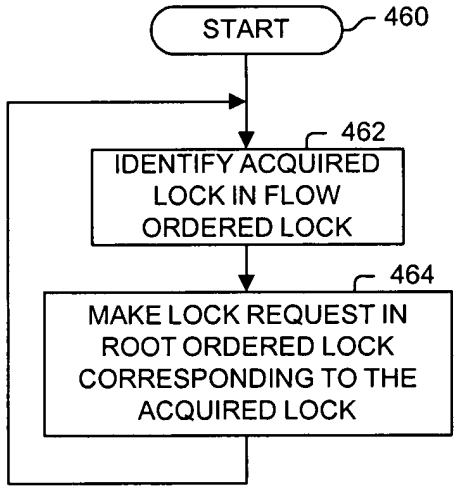

FIGURE 4D

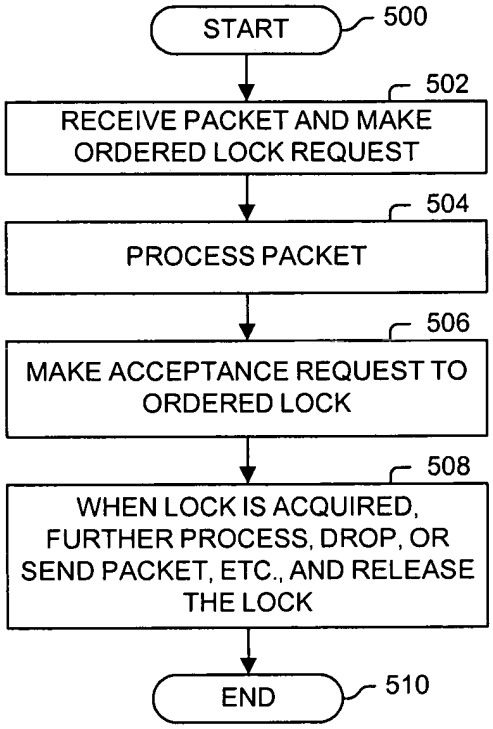
START
500
502
RECEIVE PACKET AND MAKE ORDERED LOCK REQUEST
504
PROCESS PACKET
506
MAKE ACCEPTANCE REQUEST TO ORDERED LOCK
508
WHEN LOCK IS ACQUIRED, FURTHER PROCESS, DROP, OR SEND PACKET, ETC., AND RELEASE THE LOCK
END
510

FIGURE 5A

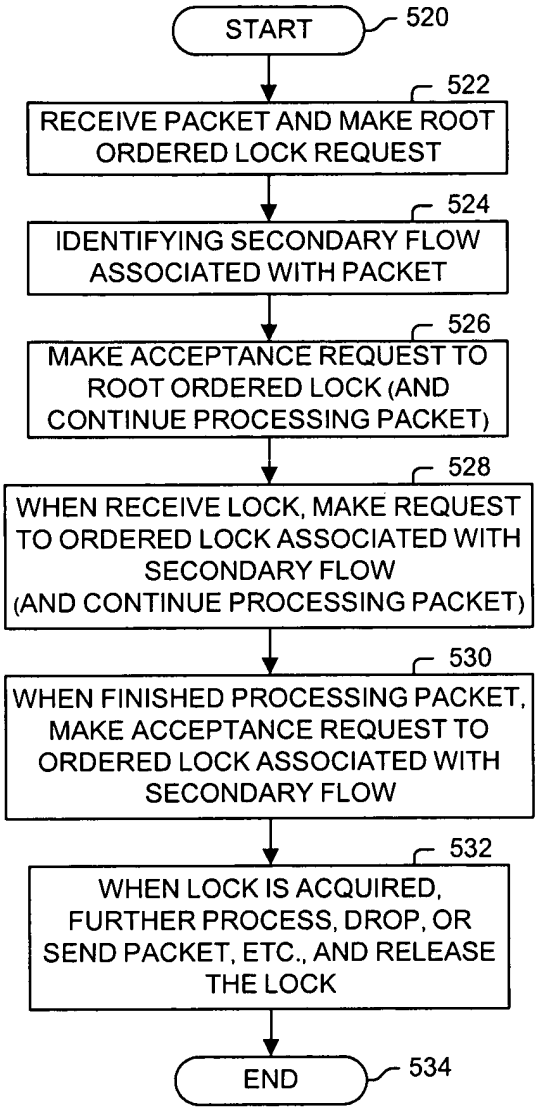
START
520
522
RECEIVE PACKET AND MAKE ROOT ORDERED LOCK REQUEST
524
IDENTIFYING SECONDARY FLOW ASSOCIATED WITH PACKET
526
MAKE ACCEPTANCE REQUEST TO ROOT ORDERED LOCK (AND CONTINUE PROCESSING PACKET)
528
WHEN RECEIVE LOCK, MAKE REQUEST TO ORDERED LOCK ASSOCIATED WITH SECONDARY FLOW (AND CONTINUE PROCESSING PACKET)
530
WHEN FINISHED PROCESSING PACKET, MAKE ACCEPTANCE REQUEST TO ORDERED LOCK ASSOCIATED WITH SECONDARY FLOW
532
WHEN LOCK IS ACQUIRED, FURTHER PROCESS, DROP, OR SEND PACKET, ETC., AND RELEASE THE LOCK
END
534

FIGURE 5B

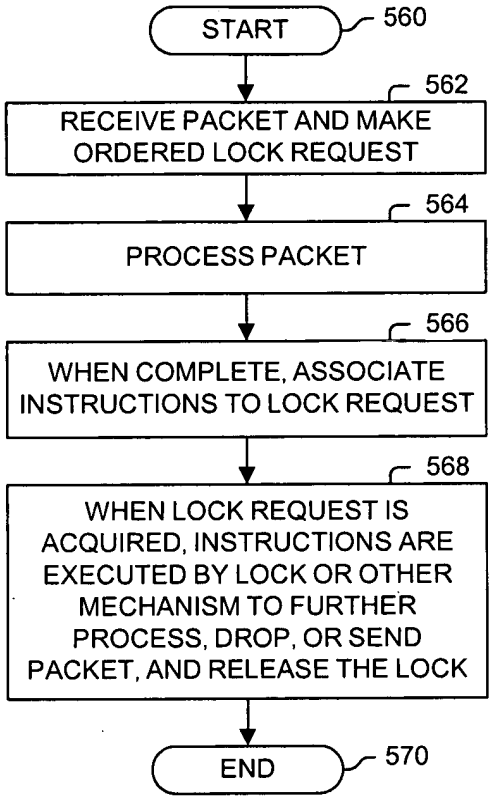
START
560
562
RECEIVE PACKET AND MAKE ORDERED LOCK REQUEST
564
PROCESS PACKET
566
WHEN COMPLETE, ASSOCIATE INSTRUCTIONS TO LOCK REQUEST
568
WHEN LOCK REQUEST IS ACQUIRED, INSTRUCTIONS ARE EXECUTED BY LOCK OR OTHER MECHANISM TO FURTHER PROCESS, DROP, OR SEND PACKET, AND RELEASE THE LOCK
END
570

FIGURE 5C

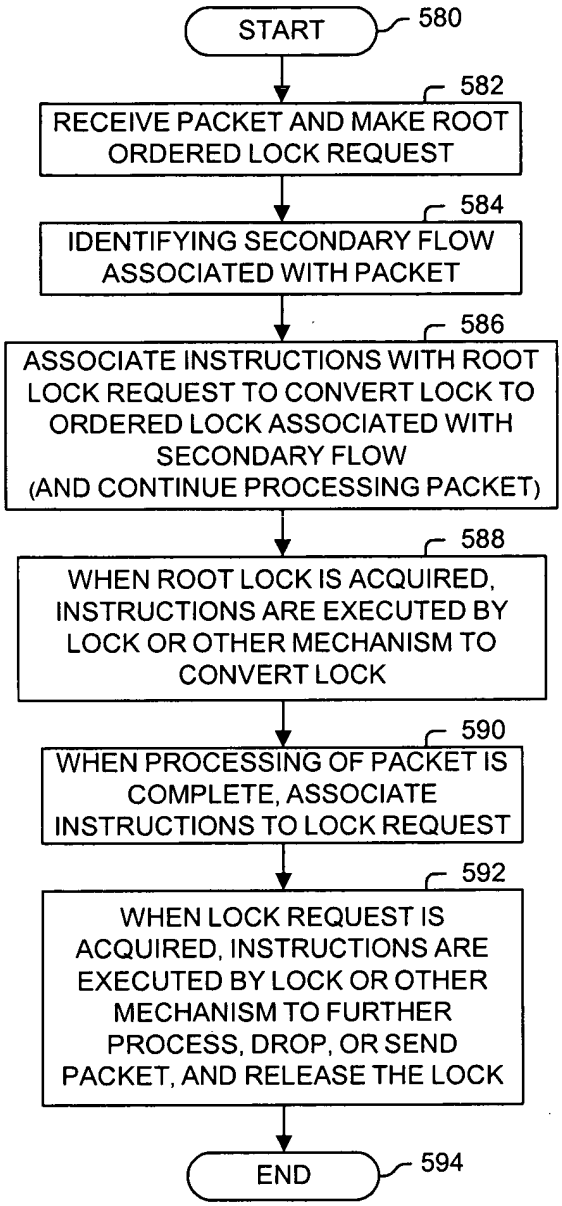
START
580
582
RECEIVE PACKET AND MAKE ROOT ORDERED LOCK REQUEST
584
IDENTIFYING SECONDARY FLOW ASSOCIATED WITH PACKET
586
ASSOCIATE INSTRUCTIONS WITH ROOT LOCK REQUEST TO CONVERT LOCK TO ORDERED LOCK ASSOCIATED WITH SECONDARY FLOW (AND CONTINUE PROCESSING PACKET)
588
WHEN ROOT LOCK IS ACQUIRED, INSTRUCTIONS ARE EXECUTED BY LOCK OR OTHER MECHANISM TO CONVERT LOCK
590
WHEN PROCESSING OF PACKET IS COMPLETE, ASSOCIATE INSTRUCTIONS TO LOCK REQUEST
592
WHEN LOCK REQUEST IS ACQUIRED, INSTRUCTIONS ARE EXECUTED BY LOCK OR OTHER MECHANISM TO FURTHER PROCESS, DROP, OR SEND PACKET, AND RELEASE THE LOCK
END
594

FIGURE 5D

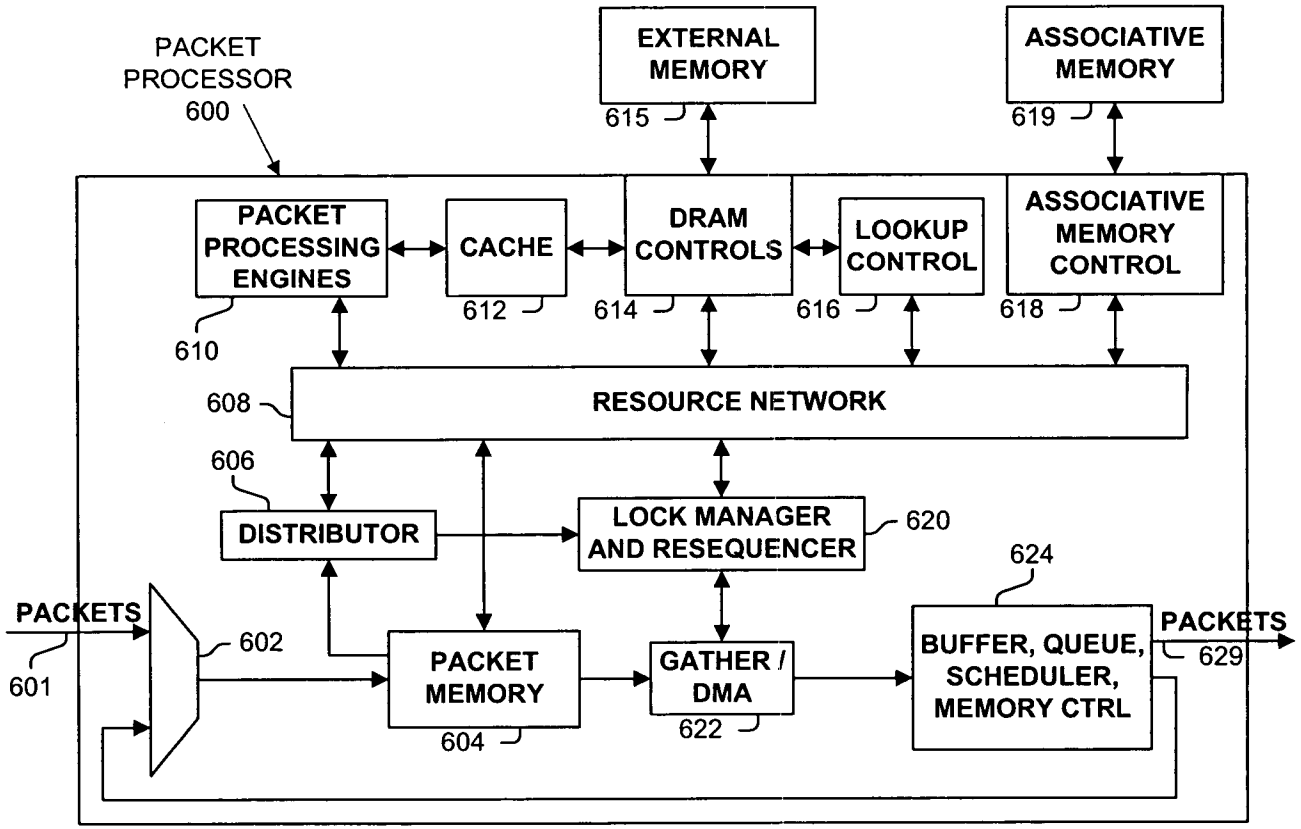
PACKET PROCESSOR
600
EXTERNAL MEMORY
615
ASSOCIATIVE MEMORY
619
PACKET PROCESSING ENGINES
610
CACHE
612
DRAM CONTROLS
614
LOOKUP CONTROL
616
ASSOCIATIVE MEMORY CONTROL
618
RESOURCE NETWORK
608
606
DISTRIBUTOR
LOCK MANAGER AND RESEQUENCER
620
624
PACKETS
601
602
PACKET MEMORY
604
GATHER / DMA
622
BUFFER, QUEUE, SCHEDULER, MEMORY CTRL
PACKETS
629

FIGURE 6A

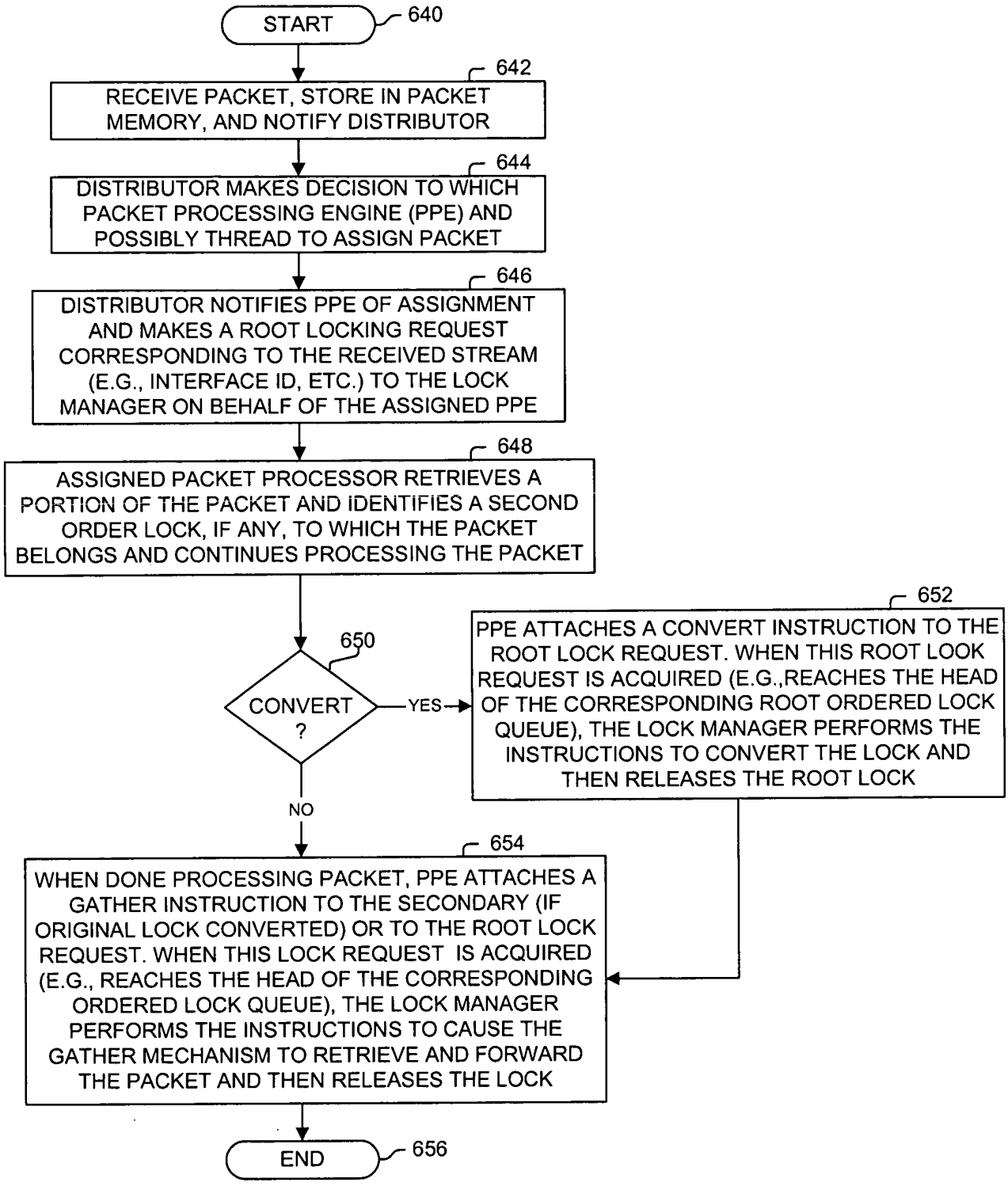
START
640
642
RECEIVE PACKET, STORE IN PACKET MEMORY, AND NOTIFY DISTRIBUTOR
644
DISTRIBUTOR MAKES DECISION TO WHICH PACKET PROCESSING ENGINE (PPE) AND POSSIBLY THREAD TO ASSIGN PACKET
646
DISTRIBUTOR NOTIFIES PPE OF ASSIGNMENT AND MAKES A ROOT LOCKING REQUEST CORRESPONDING TO THE RECEIVED STREAM (E.G., INTERFACE ID, ETC.) TO THE LOCK MANAGER ON BEHALF OF THE ASSIGNED PPE
648
ASSIGNED PACKET PROCESSOR RETRIEVES A PORTION OF THE PACKET AND IDENTIFIES A SECOND ORDER LOCK, IF ANY, TO WHICH THE PACKET BELONGS AND CONTINUES PROCESSING THE PACKET
650
CONVERT ?
YES
652
PPE ATTACHES A CONVERT INSTRUCTION TO THE ROOT LOCK REQUEST. WHEN THIS ROOT LOOK REQUEST IS ACQUIRED (E.G.,REACHES THE HEAD OF THE CORRESPONDING ROOT ORDERED LOCK QUEUE), THE LOCK MANAGER PERFORMS THE INSTRUCTIONS TO CONVERT THE LOCK AND THEN RELEASES THE ROOT LOCK
NO
654
WHEN DONE PROCESSING PACKET, PPE ATTACHES A GATHER INSTRUCTION TO THE SECONDARY (IF ORIGINAL LOCK CONVERTED) OR TO THE ROOT LOCK REQUEST. WHEN THIS LOCK REQUEST IS ACQUIRED (E.G., REACHES THE HEAD OF THE CORRESPONDING ORDERED LOCK QUEUE), THE LOCK MANAGER PERFORMS THE INSTRUCTIONS TO CAUSE THE GATHER MECHANISM TO RETRIEVE AND FORWARD THE PACKET AND THEN RELEASES THE LOCK
END
656

FIGURE 6B